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THE INSECT VECTOR OF UTA, A PERUVIAN DISEASE

CHARLES H. T. TOWNSEND

Bureau of Entomology, Washington, D. C.

The disease commonly called *uta* in Peru is largely lupus vulgaris or tubercular lupus. It is this form apparently, or a complication with it, which results, when the infection becomes far advanced, in such disastrous cases as that of Perry Boyd, photographed on page 5, volume 5, of the *Inca Chronicle* (Cerro de Pasco, Peru; October, 1913) and reproduced in part on Plate 36, Figure 2, of the Harvard School of Tropical Medicine's report of 1913 expedition to South America.

The true *uta* without tubercular complication is evidently not a more serious affection than oriental sore, to which it is very closely allied. So far as we yet know it appears to be confined to the Andean region, occurring chiefly on the western slopes in Peru, though the name *uta* is also applied in certain districts of the eastern slopes to a similar affection. Probably the chief endemic focus of *uta* is the town of Otao, situated in the next canyon north of the Rimac valley and about opposite the point where Verrugas Canyon opens into the latter. Ugaz demonstrated the inoculability of *uta* in 1886.

Dr. Albert L. Barton, of Lima, Peru, evidently was the first to arrive at a correct diagnosis of *uta* as dermal leishmaniasis. Dr. Barton has shown to the writer his notes, made in 1910, recording the discovery of the specific organism in a case treated by him, then and there identified by him as *Leishmania*. These notes were not published, due both to lack of time from professional duties and to the belief that the organism was the same as that of oriental sore (*Leishmania tropica* Wright) already recorded and described.

Jan. 3, 1913, Dr. L. Velez Lopez announced in the local press of Lima that he had discovered in *uta* lesions what he called the "cuerpo leishman peruvianum." Jan. 13, 1913, Dr. E. Escomel announced that this was a new form, for which he proposed the name *Leishmania americana* (Lav. and Natt.-Larr., 1912) var. *uta* (*Crónica Médica*, Lima, 30:414).

July 7, 1913, Gastiaturú and Rebagliati announced to the Academia Nacional de Medicina of Lima that they had found *Leishmania* in *uta* lesions (*Crónica Médica*, 30:324). The organisms were shown to the writer at the time by the authors. These findings have been still

further verified by Strong et al (Report of Harvard 1913 expedition, p. 178).^{*} The nature of the affection has therefore now been abundantly demonstrated.

The question of distinctness of the leishmaniasis occurring on the eastern slopes of the Andes and in the low-lying forested country adjacent thereto is still open. Various names have been applied to this class of infection in different regions and districts. *Espundia*, *tiacc-araña*, *juccuya*, *quecpo*, *llaga*, *apaicha*, *huaspi*, and *úlceras de los bosques* may be largely different names for the same infection. The term *espundia* is commonly applied in the montana of Peru and Bolivia along the east slopes and base of the Andes, as well as farther north in the moist montana. In the Pangoa montana of Peru, the term *llaga* obtains. In the montana of Paucartambo the affection is called *juccuya*; and in Apurimac, *quecpo*. In the Urubamba valley of Cuzco department the term *tiacc-araña* obtains. In the lower tropical rain-forest region of eastern Peru similar infections go by the names of *apaicha*, *huaspi*, and *úlceras de los bosques*, according to locality. These last are described as superficial ulcers of the skin, which begin with itching roseate spots, the small acne-like tumors that result being painful. It should be noted that this description does not agree with that of oriental sore, the lesions of which are said not to be painful. Furthermore, the lesions of true *uta* are not painful.

The natives of Convencion province below Cuzco say that *tiacc-araña* is caused by the bite of a "minute spider" (*arañita*), whence the name. The "*arañita*" is probably a larval tick, less likely a *Trombidium*, but in either case is not necessarily the carrier of the infection. In other parts of Peru, the natives describe the carrier as a small hairy, whitish fly, which is called by them *uta* and *uta venenosa*.

Laveran and Nattan-Larrier demonstrated *Leishmania* in January, 1912, in smears from lesions of a case diagnosed as *espundia*, sent them by Dr. Escomel from Arequipa, Peru (*Bull. Soc. path. exot.*, 5:176), and proposed the name *Leishmania tropica* var. *americana* for the form. Wenyon confirmed these findings almost simultaneously in a case of *espundia* from Tambopata on the lower Rio Inambari of Peru (*Jour. London Sch. Trop. Med.*, I, No. 3). Dr. Carlos Monge M. has also given full particulars of his own findings of *Leishmania americana* in cases of *espundia* and *tiacc-araña* in 1912 and 1913 (Informe al Ministerio de Instrucción del Peru, 1912; *Crónica Médica*, Lima, April 30, Oct. 15, Nov. 30, 1913).

^{*} It is well to call attention to the statements with reference to *uta* on page 6 of this report: "Its etiology hitherto had not been determined. We were able to show that *uta* is due to a species of *Leishmania*." And on page 178: ". . . the parasite discovered by us as the etiological factor of *uta*." The authors have overlooked the earlier findings.—C. H. T. T.

It is not very probable that the true *uta* of the western face of the Andes is identical with the *espundia*, *tiacc-araña*, *juccuya*, *quecpo* and *llaga* of the eastern slopes. It is still less likely that it is the same as the *bouba* (also wrongly spelled *buba*) or oral leishmaniasis of southern Brazil and northern Paraguay, known in the tropical forests of Brazil since 1759. The latter has been described by Splendore, who states, however, that it is undoubtedly to be identified with the *espundia* of Peru (*Bull. Soc. path. exot.*, 5:436, 1912). Its specific organism has been named *Leishmania brasiliensis* by Vianna (*Mem. Inst. Oswaldo Cruz.*, 6:41, 1914). The infection is stated to be contracted in the daytime in the forests of southern Brazil, and is believed to enter at any insect bite, or even at thorn scratches or other abrasion of the skin, though tabanids are indicated as the most probable and frequent agent of transmission. It is more likely that the Brazilian leishmaniasis is identical with the *apaicha*, *huaspi* and *úlceras de los bosques* of the low forest region of eastern Peru, rather than with the forms occurring higher up in the Andean valleys.

On the night of the discovery of *Phlebotomus verrucarum* Townsend, June 25, 1913, at San Bartolome, just below the mouth of Verrugas Canyon in the Rimac valley of Peru, I took some thirty specimens of *Forcipomyia utae* Knab on the inside of window panes of the railway station. These were placed in citrated artificial serum as captured. Twenty-seven specimens of the *Forcipomyia* were ground up finely in 2 c.c. of the citrated serum, warmed over flame, and injected into the ventral region of a guinea-pig, June 27, 1913, at 3:45 p. m., in the verruga laboratory at Chosica. Two injections of 1 c.c. each were made at points close together. This experiment was numbered 20. The pig was a male, born in the laboratory at Chosica, May 13, 1913, of parents from Jauja, Peru. The record of the experiment and material secured therefrom are as follows:

June 27.—Injection of 27 *Forcipomyia utae* as above detailed. Smear made from bodies of 4 gnats of same species from same lot, and numbered BS 22.

July 3.—Sore forming at point of injection.

July 5.—Sore about 1.5 cm. in diameter, subrounded, not raised, inflamed on edges, scabbed over.

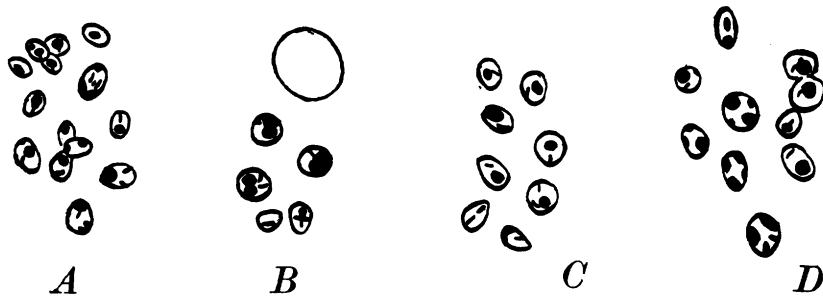
July 6.—Scab loosened easily, lifted at one side and smear made from exudation beneath, scab being let back in place. Scab dark colored, sore seems healing slowly. Smear numbered BS 23.

July 11.—Scab came away completely, and sore is seen to be covered over with a thin membranous epidermis.

July 15.—Sore healed over completely, but a small red pinhead papule has appeared at periphery of healed area on one side. This papule was well raised, 1.5 mm. in diameter, and reddish or pink. Left for further developments.

July 21.—Pig dead and discarded. Temperatures from June 3 to July 17 had been normal.

It was recognized throughout that this was not verruga, the smear from the sore seemed on examination to show nothing tangible, and the experiment was at the time deemed of no importance. The pressing requirements of the verruga investigation, especially the securing of wild flies of the *Phlebotomus* for injection in laboratory animals, prevented the proper study of this experiment. The two smears were not thoroughly examined till long afterward (November, 1913), when it was found that both showed a few bodies resembling *Leishmania*. The small pinhead papule at periphery of the healed area was then realized to have been quite certainly *uta*, and it probably contained numerous *Leishmania*. It was evidently of the same nature as the minute red papules described by Wenyon as appearing at the periphery of healed areas resulting from inoculations of oriental sore in man (PARASITOLOGY, 4: 279), and by others as following such inoculations in experimental animals.



Aug. 15, 1913, two females of *Forcipomyia townsendi* Knab came to light in my room in the railway hotel at Matucana, Peru, where I was engaged in securing nocturnal bloodsuckers for study in connection with the verruga investigation. They were placed at once in Gilson's fluid for fixation, later imbedded and sectioned Nov. 6, and 9, 1913, the four slides being numbered Sn. 20 to 23 inclusive. These showed *Leishmania* that could hardly be doubted, and caused the restudy of the two smears already mentioned.

Even with these findings I have allowed the results of this experiment to rest thus far unannounced, due to doubt of the organism being that of *uta*. There seemed always the possibility that the organism was merely a stage of a *Herpetomonas* confined to the gut of the gnats. Furthermore, *Forcipomyia townsendi*, the species which was sectioned, occurs at Chosica, which point was supposed to be outside the *uta* zone, though this may be doubted. At the time, however, I regarded *uta* as never occurring at Chosica, which threw further doubt on the findings.

Recently I have gone anew over both the material and my original notes of 1913. As a result I believe that I have substantial proof in the slides (smears and sections) of the transmission of *Leishmania uta* Escomel by both species of the *Forcipomyia*. The data are as follows:

Smear 22 (bodies of 4 *Forcipomyia utae* from San Bartolome).—Contains several forms of the *Leishmania*, as shown in Figure A. A minute flagellate form is mentioned in my original notes as found in this smear.

Smear 23 (exudation from sore of pig 20, injected 9 days previously with 27 *Forcipomyia utae* from San Bartolome of same lot as preceding).—Forms of *Leishmania* with trophonucleus dividing, shown at Figure B. Very scarce.

Section 20 (longitudinal sections of whole body of 1 female *Forcipomyia townsendi* from Matucana).—Shows numerous *Leishmania* in the abdominal region, apparently only in the gut; none to be seen in thoracic region or head. Oval to slightly pointed at one end, as shown in Figure C. Several of a large pointed flagellate form are mentioned in my original notes as found attached to wall of rectum.

Section 21 (same as preceding) did not result well.

Section 22 (transverse sections of abdomen of the other female *Forcipomyia townsendi* from Matucana).—Shows quite numerous *Leishmania* in various stages in gut, some of which are dividing, shown in Figure D.

Section 23 (debris from sections of 22).—Shows developmental stages of *Leishmania*.

The *Leishmania* is evidently voided by the gnats from the anus while feeding, and infection must take place when the bites are rubbed. Apparently there is no other possible method in which this organism can be transmitted by biting insects, since it exists in no form that can reach the salivary glands or proboscis.

The geographical range of *uta* on the west slopes of the Andes coincides quite well with that of the two species of *Forcipomyia*, which were found to occur from Chosica to Matucana, and may extend higher than the latter point. The districts in this range come mainly under the head of temperate sierra valleys, and include the deep humid quebradas of the Andes noted since ancient times as the seat of the disease. The seasonal prevalence of *uta*, given as November to April or the rainy months, coincides with the period of greatest prevalence of the *Forcipomyia*.

Two cases were noted by me and clinically diagnosed as *uta* infection, the first of which shows a history quite certainly traceable to the bites of the *Forcipomyia*, the second being in all probability due to the same cause. It was not possible to take smears from these cases at the time that I saw them, hence they lack microscopical findings.

Messrs. Chadwick and Holstein, of the Peruvian Central Railway, lay over night in their private car on the tracks at San Bartolome about March 20, 1913, and have testified that many very small gnats, both the *Phlebotomus* and others, entered their car on this occasion and

bit the inmates. Mr. Gutierrez, of Lima, a minor official of the road and an intelligent and educated man, was one of the inmates. He states that he was bitten on the hands; that he saw some of the gnats, as at least a part of the bites was received early in the evening before he retired; that the gnats that bit him while he was awake were of a dark color, as seen by the lamplight, wings not white, smaller in size than the *Phlebotomus*, but rather stouter than same and with shorter legs. Following this experience, there appeared at the bites spreading sores. I examined these sores March 29, 1913, and can testify that they bore every appearance of tropical ulcer. They were eight or ten in number, irregularly rounded, 0.5 to 1.5 cm. in diameter, inflamed at edges, not raised, faintly scabbed. I prescribed citrine ointment. The sores lasted fifteen days or so, then healed. When I saw the case again on July 1, 1913, three months after, the sites of the sores showed as purplish scars.

The second case was that of Dr. ———, assistant physician at the Cerro de Pasco Hospital, a native of Canada, who spent some days and nights in the railway hotel at Matucana, about March, 1914. He remembered being bitten at night, did not see the insect, supposed it to be a mosquito, but acknowledged that he had seen no culicids. As a matter of fact, they were absent. A half dozen or more sores appeared on his wrists and forearm, not so large as in the case of Mr. Gutierrez, and not of such a virulent appearance. They were about 0.5 to 0.8 cm. in diameter, well raised, well scabbed, the scabs being dark, not spreading and not inflamed, but they persisted for many weeks, longer than in the preceding case, finally disappearing.

Both of these cases I regard as mild infections of true *uta*, without tubercular or other complication. Such cases demand the same treatment as oriental sore, and are no more serious; perhaps not as serious as that affection. Citrine ointment, applied promptly to all bites and skin abrasions in the *uta* zones, will probably effectually prevent any advanced development of such infection. Dr. J. Leonidas Samanez states that the treatment of the developed lesions by applications of albuminate of mercury is superior to all others (*Crónica Médica*, 18:89-90, 1901). More recently neosalvarsan has been claimed by Almenara as a specific against the organism in the general circulation, and necessary to prevent its spread from advanced lesions to new localities (*Crónica Médica*, 30:476-7, Nov. 30, 1913).

The incubation period of *uta* appears to be shorter than that of oriental sore. Note that only eighteen days elapsed between injection and appearance of the pinhead papule in above Experiment 20. The disease, when uncomplicated with other infection, may also run its course in much less time.

That other insects than the *Forcipomyia* transmit *Leishmania* in Peru is very probable. Certain tabanids probably carry the organism of *apaicha* in the eastern rain-forest region. At Chachapoyas, Amazonas province, Peru, the natives accuse *Ornithodoros* n. sp. aff. *turicata* Duges (det. Nuttall and Warburton) of producing *uta* by its bites. This tick, like *O. talaje* in Mexico, inhabits the mud walls of the dwellings and sallies forth at night to bite the inmates after the manner of the bedbug; it is probably not concerned in this transmission. *Simulium* appears never to be implicated; likewise *Stomoxys* seems excluded. Both are too generally distributed. Fleas have been shown to be possible carriers of *Leishmania*; but fleas, bedbugs and ticks seem excluded in the case of *uta* and other Peruvian leishmaniasis, since the lesions are practically confined to the exposed parts of the body—hands, face and feet. Culicids are contraindicated, since all experiments tend to show that *Leishmania* degenerates in their gut. At all events, it appears certain that *Forcipomyia utae* and *F. townsendi* are implicated as vectors of true *uta* on the western side of the Andes.

In conclusion, attention should be called to one important point. As late as 1915, investigators of leishmaniasis have questioned whether the specific organism is not really a stage in the development of a *Crithidia* or *Herpetomonas* normally confined to the gut of insects, normally conveyed from insect to insect, and only accidentally transferred to man. In the present case the fact that most species of *Forcipomyia* are normally insect-biters, attacking caterpillars and certain other insects, would tend to confirm this view. *Forcipomyia utae* and *townsendi* are very abundant at times during the humid season. It may easily transpire that these gnats, while normally confining their attacks to other insects, have become accustomed, during their periods of greatest abundance, to transfer their attacks to man, due to a shortage of food-supply in the insect fauna requisite for the needs of their increased numbers.

SUMMARY

(1). The disease known as *uta*, occurring on the west face of the Andes in Peru, has been proved to be due to a *Leishmania*.

(2). Two species of *Forcipomyia*, native to the western Andean region, appear to be proved capable of transmitting the *Leishmania* of *uta*.

(3). It is highly probable that the various forms of leishmaniasis thus far known are due to as many species of herpetomonads originally parasitic in the gut of the insect-carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to merely accidental or infrequent.